PRECIPITATION SCAVENGING IN A COUPLED CHEMISTRY/CLIMATE MODEL OF SULFATE AEROSOL

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Sulfate aerosols affect global climate both directly by scattering solar radiation and indirectly by altering the cloud drop size distribution, which can change the back-scattering of solar radiation and the cloud life cycle. The negative climate forcing counteracts the warming associated with increased greenhouse gases; however, the pattern of forcing is quite different from greenhouse gas warming because the distribution of sulfate aerosol is regionally inhomogeneous. Furthermore, changes induced in the cloud drop size distributions and in regional temperature gradients can affect global temperature and precipitation patterns. Therefore, knowledge of the spatial distribution of sulfate aerosol over the globe is important.

We have recently coupled our atmospheric chemistry/transport model, GRANTOUR, with the ECHAM3 global climate model which provides several enhanced capabilities in the representation of aerosol interactions. ECHAM includes a specific representation of liquid water in large-scale clouds that allows us to represent wet phase gas-to-particle conversion of SO_2 to sulfate as well as improving the parameterization of precipitation scavenging. For mixing and scavenging by convective clouds we use the vertical mass fluxes and precipitation production rates. We will describe these parameterizations.

Results from the simulations will show the global distribution of sulfate scavenged by large-scale and convective clouds and the spatial distributions of suspended sulfur species. We also calculate the climate forcing due to anthropogenic sulfate.

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